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New Media Art

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Introduction

New Media Art is a comprehensive term that encompasses art forms that are either produced, modified, and transmitted by means of new media/digital technologies or, in a broader sense, make use of “new” and emerging technologies that originate from a scientific, military, or industrial context. Along with its emphasis on the “new,” New Media Art signifies an explicit difference—or *différance*—with art practices that make use of traditional, in other words, “old,” visual media. Hence, much of New Media Art indicates a concern with and reflection of new media and its ever-changing, complex modes of expression. A list of genres that are related to New Media Art showcases the large spectrum of this term—among others, it (commonly) includes virtual art, software art, Internet art, game art, glitch art, telematic art, software art, bio art, computer animation, interactive art, and computer graphics, as well as practices in the field of art and activism, such as hacktivism and tactical media. Given that the technologies, practices, and discourses of New Media Art are in a constant flux, the understanding of New Media Art and its affiliated genres is constantly shifting, as its—somewhat scattered—history implies. Evidently, much of New Media Art challenges the very foundations of an object-centered understanding of art, in particular with regard to its characteristics of interactivity, nonlinearity, immateriality, and ephemerality, and its intricate interrelation between artist, artwork, and spectator. It is important to note that these features are shared with other strands of contemporary and modern art and are not equally inherent within all genres of New Media Art. Nevertheless, digital technologies exceptionally allow artists to develop interactive artworks, as in Internet art and virtual art, which provide the spectator with a specific freedom of (aesthetic) choice. In other words, the aesthetic object is—in a majority of New Media Art—ultimately created by the spectator as a “user,” even though the artist assesses the framework and specific context for the action and participation of the spectator. New Media Art was coined by the interrelation of art and science from its very beginnings, because the sciences often acted as an engine of innovation and a reservoir for (aesthetic) inspiration in various art practices—conversely, New Media Art repeatedly served as an innovator for new technologies, for instance, in computer graphics, computer animation, and virtual art. In more recent years, art practices have emerged that prolong the art-science connection (as well as the notion of the artist as engineer, and vice versa) with the use of biotechnologies and biological and living material; such artistic endeavours are usually referred to as “bio art,” with proponents including Eduardo Kac and Joe Davis. A multitude of annual festivals and biennales dedicated to New Media Art—specifically to digital art—can be considered forums and catalysts for current developments regarding topics, technologies, and discourses of New Media Art.

General Overviews

The bibliographical account in this article attempts to overcome a potential constraint to monographs that are explicitly confined to New Media Art by including the most significant monographs and anthologies that are commonly referenced in the research of New Media Art, digital art, and electronic art, which has existed since over fifty years. Since 1968 most of the early debate was published in the *Leonardo Journal*. The major publications to date were published, by and large, after the turn of the millennium—because of the obvious fact that digital technologies in fine arts (with digital art as arguably the main strand of New Media Art) have a rather short history. Even though monographs and anthologies that were published before 2000 might have a limited or partial scope, they are nevertheless informative, since they discuss New Media Art primarily in relation to a wider art and media historical context, such as Popper 2007 (cited under Virtual Art and Mixed Reality). Essential monographs on the definition and discussion of Digital Art include Paul 2003 and Grau 2003. Similar publications are either dedicated to digital art as a distinct field, such as Hope and Ryan 2014, or attempt to examine the impact of digital technologies in fine arts, such as Wands 2006. Several authors have offered an explicit

introduction to new media along with an ample selection of artists who engage in new media technologies, such as the authors of Wilson 2010, Shanken 2009, and Tribe, et al. 2006. The anthology Frieling and Daniels 2004 endeavors to increase the scope through a selection of texts that discuss relevant debates and issues in (New) Media Art. In addition to publications that concentrate on the field of digital and new media technologies, Wilson 2002 offers a comprehensive and well-informed introduction to the intersection of art, science, and technology—basically a field that would constitute a bibliography of its own.

Frieling, Rudolf, and Dieter Daniels, eds. *Media Art Net 1: Survey of Media Art*. New York and Vienna: Springer, 2004.

Together with an online platform, Frieling and Daniel offer an anthology that comprises articles from some of the leading scholars in the field. The articles address the art historical background of media art, as well as the connection between art and science.

Grau, Oliver. *Virtual Art: From Illusion to Immersion*. Cambridge, MA: MIT, 2003.

Virtual Art discusses the “evolutionary” art history of illusion and immersion, demonstrating that various epochs tried to reach the maximum illusionary effect possible with the available technological means. The book offers a historic comparison in image-viewer theory of immersion today primarily based upon interaction; e.g., through real-time imagery and haptic feedback. Also offers a systematic analysis of the triad of artist, work, and viewer under the conditions of digital art.

Hope, Cat, and John Charles Ryan. *Digital Arts: An Introduction to New Media*. New York and London: Bloomsbury, 2014.

Hope and Ryan offer an up-to-date introductory digital art text that does well in the discussion of digital art in relation to other art forms and concepts such as electronic art and virtual art. Furthermore, the authors provide insights into a variety of topics in digital art, including performance, photography, glitch art, and Internet art.

***Leonardo Journal*.**

Leonardo, the journal of the International Society for the Arts, Sciences and Technology, since 1968 has been a very influential forum for professional artists to describe and discuss their work. Also since the beginning, scholars like Ernst Gombrich, Rudolf Arnheim, and William Gibson published on related themes like vision, perception, optics, color, creativity, art, and psychology.

Paul, Christiane. *Digital Art*. New York: Thames & Hudson, 2003.

Already a classic, *Digital Art* provides a critical approach to the notion of “digitality” in the arts and offers a comprehensive viewpoint on the phenomenon of digital art. Paul developed the valuable hypothesis that digital art should be distinguished from other art forms because of its use of digital technology. Therefore, media applications in New Media Art are used either as a tool or as a medium.

Rush, Michael. *New Media in Art*. London: Thames & Hudson, 2005.

New Media in Art provides a historically inclusive approach to the notion of “new media.” Instead of focusing on the last decades, Rush outlines the development of New Media Art, beginning in the 19th century, through classical avant-garde, video art, and performance art, up to contemporary art and its use of digital technologies.

Shanken, Edward A. *Art and Electronic Media*. London: Phaidon, 2009.

Shanken provides a comprehensive survey that introduces the reader to the exchange and mutual influence of contemporary media cultures and art. On the basis of a selection of New Media Artworks, *Art and Electronic Media* addresses issues such as motion, electronic production, environments, networks, bodies, and simulations.

Tribe, Mark, Reena Jana, and Uta Grosenick. *New Media Art*. Cologne: Taschen, 2006.

New Media Art provides a general—and popular—introduction to New Media Art and combines a short overview of New Media Art with a number of case studies from a variety of artistic fields. It also focuses on conceptual strategies such as appropriation, commercialization, identity privacy, and the public domain.

Wands, Bruce. *Art of the Digital Age*. New York: Thames & Hudson, 2006.

Art of the Digital Age offers a condensed history of digital art and discusses the different modes of expression ranging from digital imaging and sculpture to performance, animation, software, and Internet art.

Wilson, Stephen. *Information Arts: Intersections of Art, Science, and Technology*. Cambridge, MA: MIT, 2002.

Information Arts provides an extensive introduction to the various fields of art and science beyond the limits of specific media.

Wilson, Stephen. *Art + Science Now*. London: Thames & Hudson, 2010.

Art + Science Now is a well-illustrated, popular survey of the interrelation between art and science. The book provides an introduction to such issues as molecular biology, living systems, human biology, and physical sciences.

Virtual Art and Mixed Reality

Virtual art is an umbrella term for art forms that developed by the process of virtualization, meaning that the aesthetic object is not physically present but instead is generated by a wide range of new and “old” media. Whereas virtual art by and large is dependent on the immersion of the spectator, mixed-reality art works, including augmented reality, are a combination of physical and virtual reality, as is discussed in Geroimenko 2014. Grau 2003 argues that virtual art is a transhistorical and an immersive phenomenon that can be followed from the ancient art, through the panoramas in the 19th century up to so-called contemporary cave automatic virtual environments (CAVE). Popper 2007 offers an account of virtual art that anchors corresponding practices primarily to the art movements of the 20th century. Starting in the late 1980s, interactive installations and virtual art became artistic expressions using state-of-the-art technologies. This movement pushed the technological limits of illusion toward strategies of mentally and physically “immersing” the spectator, with artists such as Jeffrey Shaw, Charlotte Davies, and Maurice Benayoun. At present, virtual art continues to exist primarily with low-tech solutions.

Geroimenko, Vladimir, ed. *Augmented Reality Art: From an Emerging Technology to a Novel Creative Medium*. Vienna and New York: Springer, 2014.

Technologies of augmented reality (AR) are regularly used in New Media Art, but its artistic practices have seldom been documented and researched. For the first time, Geroimenko’s anthology offers a selection of essays that deal with the application and usage of AR in contemporary art.

Grau, Oliver. *Virtual Art: From Illusion to Immersion*. Cambridge, MA: MIT, 2003.

Virtual Art discusses the history of illusion and immersion within the context of art history and beyond, and establishes the hypothesis that each epoch tries to reach the maximum illusionary effect possible with the available technological means. The monograph offers a historic comparison in image-viewer theory of immersion and an “evolutionary” history of illusionism that is primarily based on interaction, e.g., through real-time imagery and haptic feedback.

Popper, Frank. *From Technological to Virtual Art*. Cambridge, MA: MIT, 2007.

Art historian Frank Popper argues that virtual art is anchored in the art practices of preceding decades and outlines its specificity, including the ever new relationship and interplay of real and virtual.

Shaw, Jeffrey, and Peter Weibel, eds. *Future Cinema: The Cinematic Imaginary after Film*. Cambridge, MA: MIT, 2003.

This catalogue accompanied the exhibition *Future Cinema*. It discusses the impact of digital technology on cinema and, furthermore, takes into consideration the history of the digital arts and new media art since the 1970s.

Computer Art and Software Art

Computer art and software art share the characteristic that the aesthetic object is produced via machine-readable instructions, i.e., software and (more fundamentally) code as a distinct language, and a computational device. Whereas the former (software) is basically immaterial, the latter (hardware) must be material. Broeckmann 2007 gives a short outline of the aesthetics of software art. Fishwick 2006 offers an anthology to so-called aesthetic computing. Klütsch 2007; Taylor 2014; Higgins and Kahn 2012; and Brown, et al. 2009 offer an investigation into the early period of computer art. Stocker and Schöpf 2003 discusses the phenomenon of “code” from a cultural perspective, whereas Russeger 2011 offers a discussion of “code” as a creative resource.

Broeckmann, Andreas. “Software Art Aesthetics.” *Mono* no 1 (July 2007): 158–167.

Broeckmann offers a short introduction to the relationship between art and software.

Brown, Paul, Charlie Gere, Nicholas Lambert, and Catherine Mason, eds. *White Heat, Cold Logic: British Computer Art 1960–1980*. Cambridge, MA: MIT, 2009.

Gere’s anthology traces the development of computer art and Internet art in Britain and discusses the role of cybernetics and other influential technological and philosophical innovations of the time.

Fishwick, Paul A., ed. *Aesthetic Computing*. Cambridge, MA: MIT, 2006.

Fishwick’s anthology comprises a broad selection of papers that discuss the aesthetic dimension of computing. The book is divided in four sections that deal with philosophy and representation, art and design, mathematics and computing, and interface and interaction. Contributions include, among others, the works of Roger Malina, Frieder Nake, Donna Cox, and Jane Prophet.

Higgins, Hannah, and Douglas Kahn, eds. *Mainframe Experimentalism: Early Computing and the Foundations of the Digital Arts*. Berkeley: University of California Press, 2012.

This anthology provides original articles that deal with the foundations of digital art in the 1960s.

Klütsch, Christoph. *Computer Grafik: Ästhetische Experimente zwischen zwei Kulturen; Die Anfänge der Computerkunst in den 1960er Jahren*. Vienna: Springer, 2007.

This work includes a thorough overview of the use of computers in art in discussing C. P. Snow's two-culture paradigm; the aesthetic of information (*Informationsästhetik*) following Max Bense; the development of generative aesthetic (*Generative Ästhetik*) of Georg Nees, Frieder Nake, and Manfred Mohr; and up to the linking of computer art to art history.

Russegger, Georg. *Coded Cultures: New Creative Practices out of Diversity*. Vienna: Springer, 2011.

In consideration of the continuously changing digital realm, this anthology comprises essays that explain the effects of "codes" on creative practices.

Stocker, Gerfried, and Christiane Schöpf. *Code: The Language of Our Time; Code=Law Code=Art Code=Life*. Ostfildern-Ruit, Germany: Hatje Cantz, 2003.

The catalogue of the Ars Electronica in 2003 accompanied one of the first exhibitions that delineated the impact of contemporary computational technologies (under the banner of "code") in various fields. A selection of leading scholars and artists have contributed short essays to the anthology.

Taylor, Grant D. *When the Machine Made Art: The Troubled History of Computer Art*. New York: Bloomsbury, 2014.

When the Machine Made Art is a profound and well-researched history of software art. The book sheds light on forgotten practitioners and debates starting in the 1960s. Taylor identifies the destabilizing forces that shaped and eventually fragmented the computer art movement.

Telematic Art

Essentially, telematic art employs technologies that are used for telecommunication. The very nature of telematic art—i.e., its focus on a mediated exchange through telecommunication—is often regarded as a challenge to art forms that rely on a "passive" audience. Artists like Roy Ascott, Kit Galloway, and Sherrie Rabinowitz developed technologically innovative New Media Art, namely, telematic art, which responded to the transgression of (territorial) boundaries through the expanding possibilities of worldwide one-to-many communication technologies. Ascott 2003 offers an overview of essays by one of the most prominent practitioners and scholars in the field of telematic art. Grau 2003 and Kusahara 2000 reflect upon the epistemological foundations of telematic art. Kac 2005 offers a wide range of essays on the issue of telematics. Goldberg 2000 explores the concept of tele-epistemology and telerobotics.

Ascott, Roy. *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*. Edited by Edward A. Shanken. Berkeley: University of California Press, 2003.

Telematic Embrace is an anthology that consists of several essays by Roy Ascott. It outlines his groundbreaking approach to telematic art and his notions on interactivity, aesthetics, and network.

Dinkla, Söke. *Pioniere interaktiver Kunst von 1970 bis heute: Myron Krueger, Jeffrey Shaw, David Rokeby, Lynn Hershman, Grahame Weinbren, Ken Feingold*. Ostfildern-Ruit, Germany: Cantz, 1997.

Dinkla recapitulates the history of interactive and telematic art and different artistic strategies to involve the spectator in the production of the artwork, following the work of its most famous proponents.

Goldberg, Ken, ed. *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*. Cambridge, MA: MIT, 2000.

Goldberg's anthology is still one of the essential volumes regarding "tele-epistemology" and telematic art and includes a variety of papers from the best-known practitioners and scholars in the field, including Martin Jay and Eduardo Kac.

Grau, Oliver. "Telepräsenz: Zu Genealogie und Epistemologie von Interaktion und Simulation." In *Formen interaktiver Medienkunst: Geschichte, Tendenzen, Utopien*. Edited by Peter Gendolla, 19–38. Frankfurt: Suhrkamp, 2003.

Grau's contribution is a theoretical and practical reflection of telepresence in connection with robotics, telecommunications, and virtual reality.

Kac, Eduardo. *Telepresence and Bio Art*. Ann Arbor: University of Michigan Press, 2005.

The essays in this collection were written by one of the leading artists in the field of bio art and telepresence. The Brazilian artist highlights his changing artistic and research endeavours.

Kusahara, Machiko. "Presence, Absence, and Knowledge in Telerobotic Art." In *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*. Edited by Ken Goldberg, 198–214. Cambridge, MA: MIT, 2000.

Kusahara discusses four artists along the lines of disembodiment, proximity, and virtual spaces and as a result provides some interesting insights into telerobotic art.

Performance

Since early in the 21st century, the use of digital technologies in performance has been the subject of a variety of publications. The impact of contemporary media is discussed in Benford and Giannachi 2011, Broadhurst and Machon 2006, Carver and Beardon 2004, Dixon and Smith 2007, Kozel 2007, and Salter 2010.

Benford, Steve, and Gabriella Giannachi. *Performing Mixed Reality*. Cambridge, MA: MIT, 2011.

Benford and Giannachi discuss the impact of contemporary technologies on performance and describe this connection as mixed-reality performance in order to highlight the liminal stage between virtual and physical reality.

Broadhurst, Susan, and Josephine Machon, eds. *Performance and Technology: Practices of Virtual Embodiment and Interactivity*. New York: Palgrave, 2006.

Broadhurst's anthology compiles a selection of articles in the field of digital performance and provides an overview of the interplay between performance and its use of (digital) technology.

Carver, Gavin, and Colin Beardon, eds. *New Visions in Performance: The Impact of Digital Technologies*. Lisse, The Netherlands: Swets & Zeitlinger, 2004.

This anthology focuses on the influence of technology upon the performing arts.

Dixon, Steve, and Barry Smith. *Digital Performance: A History of New Media in Theater, Dance, Performance Art, and Installation*. Cambridge, MA: MIT, 2007.

Dixon and Smith discuss the establishment and use of new media in the history of performing arts and its aesthetic, theoretical, and technological implications.

Kozel, Susan. *Closer: Performance, Technologies, Phenomenology*. Cambridge, MA: MIT, 2007.

Grounded in artistic research, Kozel aims to transform the philosophy of phenomenology (Merleau-Ponty) into performance, and to use digital experiments with embodiment as catalysts for understanding wider social and cultural uses of digital technologies.

Salter, Chris. *Entangled: Technology and the Transformation of Performance*. Cambridge, MA: MIT, 2010.

This work is a wide-reaching inquiry into performance artists' use of technology. It shows how performance is merged into a variety of different aesthetic, technologic, social, and narrative practices.

Internet Art

Obviously, the 1990s were fundamentally influenced by the advent of digital technologies, and the economic and cultural consolidation of the Internet led to an increase of new expressions in New Media Art. Internet art provided a critical perspective on up-to-date communication technologies, with artists such as Vuk Ćosić and Heath Bunting. Internet art is a term that signifies artworks that engage in the realm (and employ the technology) of the Internet. Some of its prime characteristics are its time-based and (commonly) interactive nature, as well as the ephemerality of its aesthetic objects. Stallabrass 2003 and Greene 2004 present compact introductions to Internet Art. More recent publications attempt to outline the field, such as Adler, et al. 2014 and Bosma 2011. Beyond an exclusive focus on Internet art, Corby 2006 and Munster 2014 offer a wider perspective on art forms that make use of networks.

Adler, Phoebe, Leanne Hayman, and Arrate Hidalgo. *Art and the Internet*. London: Black Dog, 2014.

Art and the Internet is an anthology and offers an introduction to a wide range of technological, social, historical, and artistic examples essential for the development of Internet art and introduces a wide range of practitioners.

Bosma, Josephine. *Nettitudes: Let's Talk Net Art*. Rotterdam, The Netherlands: NAI, 2011.

Nettitudes is an anthology consisting of five essays by Josephine Bosma that deal with the definition of Internet art, the development of "net.art," archiving, and music in and with New Media.

Chandler, Annmarie, and Norie Neumark. *At a Distance: Precursors to Art and Activism on the Internet*. Cambridge, MA: MIT, 2005.

Chandler and Neumark's anthology offers a variety of articles that delineate the art historical and technological progenitors of Internet art, including mail art, telematic art, appropriation art, and Fluxus, and establishes a basis for the understanding of art practices that rely on networks.

Corby, Tom. *Network Art: Practices and Positions*. London and New York: Routledge, 2006.

Corby's anthology consists of essays by some of the leading scholars in the field, including Josephine Bosma, Tilman Baumgärtel, and

Sarah Cook. Moreover, he questions the notion of network(ed) art in regard to projects that make use of websites, mailing lists, installations, and performances.

Greene, Rachel. *Internet Art*. London: Thames & Hudson, 2004.

Greene's *Internet Art* offers a comprehensive guide to art practices that make use of Internet technologies. She establishes a reliable basis for understanding the field.

Munster, Anna. *An Aesthesis of Networks: Conjunctive Experience in Art and Technology*. Cambridge, MA: MIT, 2014.

Networking and technologies of networking are ubiquitous and yet, their visualizations are seemingly interchangeable. Munster is opposed to this trend and attempts to model a new theory of network experiences.

Stallabrass, Julian. *Internet Art: The Online Clash of Culture and Commerce*. London: Tate, 2003.

Stallabrass offers a compelling reflection upon Internet art against the backdrop of the sociopolitical and economic developments that emerged in line with the advent of the internet. Various chapters deal with such issues as the form of data, interactivity, and art institutions.

Weibel, Peter, ed. *Net_condition: Art and Global Media*. Cambridge, MA: MIT, 2001.

Net_condition was one of the first publications that addressed the impact of global, networked media on the social, political, and artistic field. *It* emerged from an exhibition of the same name and introduces a variety of different scholars and artists.

Game Art and Machinima

In more recent years, considerable research has pinpointed the rise of the economic and cultural importance of games; for example, Flanagan and Nissenbaum 2014 considers the political value of games. Despite this development, only a few scholars have discussed game art as a distinct art form. The research into game art has been confined, more or less, to only small chapters in monographs that dealt with digital art. Only recently have the first research projects emerged that concentrated on this field of artistic practice, including Sharp 2015 and Schwingeler 2014.

Flanagan, Mary, and Helen Nissenbaum. *Values at Play in Digital Games*. Cambridge, MA: MIT, 2014.

Flanagan and Nissenbaum's monograph encompasses insightful research in the moral and political values that are inherent to digital games.

Lowood, Henry, and Michael Nitsche, eds. *Machinima Reader*. MIT, 2011.

Collected by leading scholars, this first collection of critical texts gives an overview of the rapidly developing field. Contributions from academics and practitioners range from technical to medial, legal, pedagogical, and aesthical aspects of this specific game-based cultural production.

Ng, Jenna, ed. *Understanding Machinima: Essays on Filmmaking in Virtual Worlds*. New York: Bloomsbury Academic, 2013.

The collection includes academics, artists, and machinima-makers and provides wide-ranging discussions addressing machinima from theoretical perspectives, as well as in its many dimensions as game art, First Nations media art, and documentary and pedagogical tools.

Schwingeler, Stephan. *Kunstwerk Computerspiel: Digitale Spiele als künstlerisches Material; Eine bildwissenschaftliche und medientheoretische Analyse.* Bielefeld, Germany: transcript, 2014.

Even though there are several publications concerning gaming and gamification, only a few researchers have concentrated upon the appropriation of games in an art context. Schwingeler's *Kunstwerk Computerspiel* is a rigorous contribution attempting to fill this gap.

Sharp, John. *Works of Game. On the Aesthetics of Games and Art.* Cambridge, MA: MIT, 2015.

This publication attempts to reinforce a "ludic perspective" on the arts and establishes an overview of the aesthetics of art forms that engage in the strategies of gaming from avant-garde art to contemporary (digital) game art.

Glitch Art

Glitch art refers to art forms that make use of errors and distortions of analogue or digital media. Krapp 2011, Menkman 2011, and Nunes 2011 offer introductions to this recently emerging field of artistic practice. Cates 2013 tries to recap the (short) history of Glitch Art.

Cates, Jon. "Re:Copying-it-RIGHT AGAIN." In *Relive: Media Art Histories*. Edited by Sean Cubitt and Paul Thomas, 337–345. Cambridge, MA: MIT, 2013.

Cates discusses the young history of glitch art.

Krapp, Peter. *Noise Channels: Glitch and Error in Digital Culture.* Minneapolis: University of Minnesota Press, 2011.

Krapp follows the creative potentials of noise and distortion of digital technologies and helps to define a field that has emerged over the course of the last few years. Throughout new media cultures, he traces a resistance to the heritage of motion studies, ergonomics, and efficiency, showing how creativity is melded into the networks of digital culture.

Menkman, Rosa. *The Glitch Moment(um).* Amsterdam: Institute of Network Cultures, 2011.

Rosa Menkman introduces the reader to early information theorists not usually encountered in glitch's theoretical foundations to refine a signal and informational vocabulary appropriate to glitch's technological moment(um) and orientations. The book makes sense of recent glitch art and culture: technically, culturally, critically, and aesthetically, and finally as a genre.

Nunes, Mark. *Error: Glitch, Noise, and Jam in New Media Cultures.* New York: Bloomsbury Academic, 2011.

This collection of essays explores the political, cultural, and aesthetic possibilities of error and noise in a society predicated upon efficient, reliable information exchange. The contributing authors explore a range of topics, including glitch art, equivocation in stock imagery, tactical media, and the seduction of error.

Activism, Hacktivism, and Tactical Media

Critical endeavours such as hacktivism (a portmanteau term that merges hacking and activism) go beyond the context of art and engage in the field of political and social activism. Monographs that are concerned with media art practices that critique the dominant political order via hacktivism and tactical media, such as Bazzichelli 2013 and Raley 2009, point out the various digital means and objectives of hacktivism and tactical media.

Bazzichelli, Tatiana. *Networked Disruption: Rethinking Oppositions in Art, Hacktivism and the Business of Social Networking*. Aarhus, Denmark: Digital Aesthetics Research Center, 2013.

Bazzichelli discusses the oppositional and activist practices in art and culture, such as hacktivism, and situates them at the intersection of art, business, and civil “disruption.”

Raley, Rita. *Tactical Media*. Minneapolis: University of Minneapolis Press, 2009.

Raley provides a critical introduction to the practices of tactical media (understood as interventionist Media Art), which usually engages in the realm of digital technology.

Bio Art and Transgenic Art

Bio art is a field of artistic endeavour that makes use of living/semi-living material and/or technologies that are derived from a scientific context such as the emerging life sciences. Its major issues and an overview of current debates are provided by a number of authors, such as those of Gessert 2010, Mitchell 2010, Reichle 2009, Kac 2007, Hauser 2005, Anker and Nelkin 2004, and Grau 2000. Already in the late 1980s, the first new media artists started to engage with 3D technologies, including William Latham, who simulated evolutionary processes via early digital software.

Anker, Suzanne, and Dorothy Nelkin. *The Molecular Gaze: Art in the Genetic Age*. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 2004.

The Molecular Gaze is a well-informed anthology and contribution to the ethical and moral implications of biotechnology and its effects on contemporary identity, discussed primarily from the perspective of the arts.

Gessert, George. *Green Light: Toward an Art of Evolution*. Cambridge, MA: MIT, 2010.

Gessert provides a historical overview of the different means of influencing and creating hybrid life forms, from Steichen's delphinium to current trends in bio art.

Grau, Oliver. “Lebendige Bilder schaffen: Virtuelle Realität, Artificial Life und Transgenic Art.” In *Sieben Hügel: Dschungel. Sammeln, Ordnen, Bewahren: Von der Vielfalt des Lebens zur Kultur der Natur*. Edited by B.-M. Baumunk and J. Joerges, 47–53. Berlin: Henschel Verlag, 2000.

Grau compares and contrasts the intimate interrelation between virtual reality, artificial life, and bio art as illustrated by artworks by Eduardo Kac, Christa Sommerer, and Laurent Mignonneau.

Hauser, Jens. “Bioart: Taxonomy of an Etymological Monster.” In *Hybrid: Living in a Paradox*. (Ars Electronica 2005). Edited

by **Gerfried Stocker and Christiane Schöpf, 181–192. Ostfildern-Ruit, Germany: Hatje Cantz, 2005.**

Hauser, one of the leading scholars and theoreticians in field of bio art, offers a critical essay on the definition of bio art in an attempts to define the field.

Kac, Eduardo, ed. *Signs of Life: Bio Art and Beyond*. Cambridge, MA: MIT, 2007.

One of the most important proponents of bio art, Eduardo Kac, provides an anthology of essays by its foremost practitioners and theoreticians, including Eugene Thacker, Dorothy Nelkin, George Gessert, and Joe Davis.

Mitchell, Robert E. *Bioart and the Vitality of Media*. Seattle: University of Washington Press, 2010.

The goal of *Bioart and the Vitality of Media* is to unravel the wide-ranging discourses of bio art and offer a prolific understanding that contextualizes corresponding art practices at the intersection of art history, natural sciences, and media theory.

Reichle, Ingeborg. *Art in the Age of Technoscience: Genetic Engineering, Robotics, and Artificial Life in Contemporary Art*. Vienna: Springer, 2009.

Art in the Age of Technoscience is a survey of art forms that engage in the field of molecular biology, robotics, and artificial life.

Media Concepts and Technologies Around 2000

Since the early 1990s, a veritable flood of monographs and anthologies have been dedicated to the issue of new media. Well-informed introductions, which can already be considered as standard texts, are offered by Lister, et al. 2003 and Thorburn and Jenkins 2003. Packer, et al. 2002 comprises a selection of papers that range from current research into new media studies to, by and large, new media studies *avant la lettre*. Bolter and Grusin 1999 discusses new media's characteristics corresponding to the authors' theory of "remediation" and "hypermediacy." Manovich 2001 is still one of the essential monographs. The anthology Thorburn and Jenkins 2003 offers valuable insights into the evolution of media technologies.

Bolter, Jay David, and Richard Grusin. *Remediation: Understanding New Media*. Cambridge, MA: MIT, 1999.

Bolter and Grusin argue against the widespread conception that new media technologies are based on a distinctly new and historically singular aesthetic. Among other assumptions, the authors develop the influential hypothesis that new media inherits and "remediates" the formal characteristics of "old" media, while at the same time it is displaying its characteristics of "hypermedia."

Lister, Martin, Jon Dovey, Seth Giddings, et al., eds. *New Media: A Critical Introduction*. London and New York: Routledge, 2003.

Lister and his coauthors offer one of the standard textbooks in media theory for the introduction to debates and technologies in new media.

Manovich, Lev. *The Language of New Media*. Cambridge, MA: MIT, 2001.

Manovich provides an influential new-media theory that draws upon concepts from a variety of disciplines ranging from film studies to computer science. He endeavors to delineate the specificity of digital technologies and uses cinema as a progenitor and comparison to the aesthetics of new media.

Packer, Randall, Ken Jordan, and William Gibson, eds. *Multimedia: From Wagner to Virtual Reality*. New York: Norton, 2002.

Packer's anthology offers a collection of papers written by contemporary and avant la lettre theorists of multimedia. The book is structured along guidelines of integration, interactivity, hypermedia, and immersion.

Thorburn, David, and Henry Jenkins, eds. *Rethinking Media Change: The Aesthetics of Transition*. Cambridge, MA: MIT, 2003.

This anthology offers a collage of essays that all address the development of media technologies and its cultural implications. Instead of a focus on current media cultures, the contributors to *Rethinking Media Change* discuss the inherent characteristics of "media revolution" in various epochs.

Early Debates

The earliest art works that are commonly and—more or less—explicitly described as New Media Art date from the 1960s and are closely linked with the advent of new imaging technologies, such as video. Furthermore, technological developments in computer graphics, as conducted by Frieder Nake and A. Michael Noll; exhibitions such as "Cybernetic Serendipity"; and organizations including Experiments in Art and Technology made way for the "aestheticizing of technology" as well as the "technologizing of art." Along with the first exhibitions dedicated to computer art, several publications were distributed around 1970. Burnham 1968 has a central role in the early discourses, since the author provided one of the first accounts of the fertile interrelation of science and art, concentrating on its impact on sculpture. Similarly, Youngblood 1970 starts its discussion from a classical form of media art, namely, cinema and film, and thereafter approaches the field of video and computer science. The aesthetics of early computer art are addressed by Franke 1971, whereas Nake 1974 develops the influential concept of information aesthetics. Reichardt 1971 must be regarded as one of the first accounts of cybernetics in art. Even though Popper 1975 concentrates on participatory art forms, it pinpoints some of the early works of New Media Art in line with the author's study of art forms that are breaking down the concept of the "passive" audience.

Burnham, Jack. *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of This Century*. London: Penguin, 1968.

With *Beyond Modern Sculpture*, Burnham provides the most significant research in the early discourse of the entanglement of art and science.

Franke, Herbert W. *Computergraphik: Computerkunst*. Munich: Bruckmann, 1971.

Franke, one of the founding fathers of the Ars Electronica, published one of the first books that concern the history and the contemporary endeavours of computer art, including its aesthetic aspects and various devices.

Nake, Frieder. *Ästhetik als Informationsverarbeitung: Grundlagen und Anwendungen der Informatik im Bereich ästhetischer Produktion und Kritik*. Vienna and New York: Springer, 1974.

Frieder Nake, a leading innovator in computer graphics, has developed a new concept of information aesthetics (Informationsästhetik).

Popper, Frank. *Art: Action and Participation*. London: Studio Vista, 1975.

Popper has developed a comprehensive study of art phenomena that addresses the breakdown of the "passive" audience. He does not restrict himself to a single genre and brings together Dada, action painting, and conceptual art, as well as New Media Art, along with the driving force of the participation of the spectator.

Reichardt, Jasia. *The Computer in Art*. London: Studio Vista, 1971.

Jasia Reichardt, the curator behind the path-breaking Cybernetic Serendipity exhibition, provides a survey of cybernetics in art.

Youngblood, Gene. *Expanded Cinema*. New York: E. P. Dutton, 1970.

Departing from a discussion of contemporary cinema, Youngblood expands his focus toward contemporary media such as computer science and video that, in his words, provide an “expanded consciousness.”

Current Debates

New Media Art and its use of emerging technologies allow for ever-changing modes of expression and, therefore, address a variety of different issues that are continually debated. The titles in this section should not be considered general introductions to New Media Art, but rather as contributions that identify certain aspects of New Media Art. Furthermore, a comprehensive list of titles that participate in the current discourse of New Media Art would go beyond the scope of this bibliography—that makes this list a kind of “spotlight.” In this vein, Gere 2006 discusses the impact of digital and emerging technologies in fine art. Besides the introductory monographs and anthologies in this article, the aesthetics of New Media Art are discussed by a number of works: Kwastek 2013 addresses the ever-changing aesthetics of interactive art via digital art; Lovejoy, et al. 2010 discusses the interchange between artists and engineers and its impact on the aesthetics of New Media Art. Vesna 2007 opens up a perspective on New Media Art from the outlook of the so-called Information Age. The question of gender in “technological” art practices is addressed by Malloy 2003. Kahn 1999 offers an immense history and theory of the role of sound. Issues of copyright are discussed by Guertin 2012. Spielmann 2013 examines the aspect of cultural hybridization in the case of Japanese New Media Art. A perspective on New Media Art from a theological, religious, and cultural standpoint is offered by Marks 2010. The interplay of art and science is discussed in Whitelaw 2004 and Sommerer and Mignonneau 1998. In order to reinforce the field of New Media Art—e.g., in regard to concerted restoration and conservation strategies as well as research projects—Grau 2013 advocates for an international exchange and structure.

Gere, Charlie. *Art, Time, and Technology: Histories of the Disappearing Body*. Oxford and New York: Berg, 2006.

Against the backdrop of the increasing pace of communication technologies, *Art, Time, and Technology* discusses the ways in which various practices of art are reacting to the growing importance of information and computer technologies.

Grau, Oliver. “New Perspectives for the (Digital) Humanities.” In *The Challenge of the Object: Proceedings of the 33rd Congress of the International Committee of the History of Art*. Edited by G. Ulrich Großmann and Petra Krutisch, 990–994. Nuremberg, Germany: Verlag des Germanisches Nationalmuseum, 2013.

In the humanistic tradition, Digital Art opens up thinking spaces of reflection substantial contemporary discussions, challenges, dangers, and proposed transformations of our lives in relation to the digital era. Digital Art is the art form with the most comprehensive potential of visualization of our information societies, thematising globalization, media and image revolution, climate change, surveillance, virtualization of global finance. . . But due to the imminent problems of archiving, the digital arts are threatened by its loss—a problem that is reinforced by the insufficient practices of cultural institutions to display, collect and research digital art. Post-industrial societies require digital arts based on contemporary media dispositive to reflect upon current and future challenges, just like art history was always informed by its contemporary media technologies. By establishing concerted international strategies and new scientific tools it is the aim to put media art histories on a contemporary basis in order to enable the humanities to meet with its (current) responsibilities.

Guertin, Carolyn. *Digital Prohibition: Piracy and Authorship in New Media Art*. London and New York: Continuum International, 2012.

Digital Prohibition discusses the global politics of creative work and emergent models of authorship in a digital age. It is a wide-ranging study of collaborative, illegal, and remixed New Media Art in the West and the East (especially China and Pakistan).

Kahn, Douglas. *Noise, Water, Meat: A History of Sound in the Arts*. Cambridge, MA: MIT, 1999.

Kahn's different and yet challenging history of sound in new media reconsiders the canon of art history.

Kwastek, Katja. *Aesthetics of Interaction in Digital Art*. Cambridge, MA: MIT, 2013.

Kwastek comprehensively introduces the history, theory, and terminology of interactive art with the general objective of developing an updated theory of the aesthetics of interaction against the backdrop of digital art and New Media Art.

Lovejoy, Margot, Christiane Paul, and Victoria Vesna, eds. *Context Providers: Conditions of Meaning in Media Arts*. Bristol, UK, and Chicago: Intellect, 2010.

This anthology proposes an insight into the ongoing debate about the changing role of the artist in New Media Art and compiles a list of various contributions of leading scholars and artists from the field.

Malloy, Judy. *Women, Art, and Technology*. Cambridge, MA: MIT, 2003.

Women, Art, and Technology is the first anthology that addresses the contribution of women to the field of art and technology and comprises texts from some of its foremost practitioners.

Marks, Laura U. *Enfoldment and Infinity: An Islamic Genealogy of New Media Art*. Cambridge, MA: MIT, 2010.

Enfoldment and Infinity discovers and invents "roots" of New Media Art in Islamic art, including basis in code, aniconism, performativity, and unfolding from an invisible source. It demonstrates that concepts from classical Islamic philosophy give the reader new and fruitful ways to think about algorithmic art and traces how Islamic aesthetics journeyed westward from medieval times to the present, in "the haptic transfer and the travels of the abstract line."

Sommerer, Christa, and Laurent Mignonneau. *Art @ Science*. Vienna: Springer, 1998.

These articles, edited by the artists, deal with the relationship and long-standing separation of art and science and other issues such as artificial life, computer graphics, and scientific visualisations.

Spielmann, Yvonne. *Hybrid Culture: Japanese Media Arts in Dialogue with the West*. Cambridge, MA: MIT, 2013.

Undoubtedly, Japan is a global driving force for media and technological innovation. However, Spielmann has discovered an essential hybridity in Japan's media culture: an internal hybridity, a mixture of digital-analog connections together with a non-Western development of modernity separate from but not immune to Western media aesthetics; an external hybridity, produced by the international, transcultural travel of aesthetic concepts.

Vesna, Victoria, ed. *Database Aesthetics. Art in the Age of Information Overflow*. Minneapolis: University of Minnesota Press, 2007.

Vesna's anthology postulates that databases, understood as a distinctive cultural form, have affected the aesthetics of various artworks. Vesna is confident that New Media Art, which is technologically predestined to address network culture and participation, has

contributed to such a development.

Whitelaw, Mitchell. *Metacreation. Art and Artificial Life*. Cambridge, MA: MIT, 2004.

Whitelaw offers a discerning overview of the artistic and cultural practices striving to imitate living systems. It considers artificial evolution, simulated ecosystems, robotics, and other generative systems, arguing that the phenomenon of emergence is central to art's engagement with artificial life.

Historical Approaches (Media Art Histories)

Various research initiatives, including media art history, media archaeology, and image science, attempt to connect art history and media history in order to excavate early phenomena of New Media Art, such as 19th-century panoramas or pre-cinematic apparatuses. A majority of scholars emphasize New Media Art's association with 20th-century avant-garde art, including kinetic art's focus on the aesthetics of movement, Dada's use of accident and chance, pop art's practice of appropriation, conceptual art's rejection of object-centered aesthetics, and performance art's overcoming the boundaries between reality and art, as well as its emphasis on audience participation. More recently, New Media Art has increasingly become the subject of research projects that were developed by the interdisciplinary and intercultural contexts of the histories of art. Such approaches to New Media Art discuss the interaction of art, science, and technology to assess a status quo of New Media Art against the backdrop of art history and media history. This approach is represented by the biannual, worldwide conference series Media Art Histories, which is documented in Grau 2007, Broeckmann and Nadarajan 2008, and Cubitt and Thomas 2013. Huhtamo and Parikka 2011 presents an introduction to the theory and practice of media archaeology, which aligns with the approach of media art history. Gitelman 2003 appropriates the notion of the "new" to technologies that originated before World War I.

Broeckmann, Andreas, and Gunalan Nadarajan, eds. *Place Studies in Art, Media, Science and Technology: Historical Investigations on the Sites and the Migration of Knowledge*. Weimar, Germany: VDG, 2008.

Starting from the notion of "space," Broeckmann and Nadarajan assemble a collection of essays that examine the complex field of art, science, and technology in relation to space.

Cubitt, Sean, and Paul Thomas, eds. *Relive: Media Art Histories*. Leonardo. Cambridge, MA: MIT, 2013.

Cubitt and Thomas's contribution to the Leonardo series on media art histories compiles different papers arranged according to the following issues: methods, research endeavours in Europe, Australia, and New Zealand; artificial life; and visualization and imaging strategies.

Gitelman, Lisa, ed. *New Media: 1740–1915*. Cambridge, MA: MIT, 2003.

New Media: 1740–1915 is an anthology that provides an alternative perspective to the concept of "new media." Gitelman emphasizes the "newness" of "old" media as well as the mechanism of media transition in different historical contexts, namely, from Baroque up to the beginning of the 20th century.

Grau, Oliver, ed. *MediaArHistories*. Cambridge, MA: MIT, 2007.

This anthology compiles articles that place (new) media art in the context of art history and develops an interdisciplinary approach, including film and media studies, computer science, philosophy, and image sciences.

Huhtamo, Erkki, and Jussi Parikka, eds. *Media Archaeology: Approaches, Applications, and Implications*. Berkeley: University of California Press, 2011.

The anthology *Media Archaeology* introduces the concept of media archaeology and offers some examples of its application by several authors, including Eric Kluitenberg, Thomas Elsaesser, Noah Wardrip-Fruin, and Vivian Sobchak.

Curating, Restoring, and Preserving

Since 2000, the issues of curating, restoration, and preservation have received more attention. Because of the persistent technological progress, New Media Art relies on technologies that are eventually outdated. This obsolescence, in turn, is the reason that the permanent collection of much of New Media Art is problematic—a situation that poses fundamental challenges for museums and cultural institutions in the preservation of New Media Art, as well as the digital heritage in general. Similarly, the presentation and curating of New Media Art is often problematic for museums that are not equipped for the specific technological needs of New Media Art. In this vein, Buschmann 2013 offers an overview of current debates in preservation, along with presentation techniques that are characteristic of New Media Art. Grau 2003 develops an expanded concept of documentation for digital art. Concentrating on the aspect of presentation, Cook and Graham 2010 draws upon the challenges of the specific context of display that has to be mastered by curators of New Media Art. Graham 2014 draws on a variety of examples from all over the world. Serexhe 2013 offers a well-informed anthology of the ethical and practical implications of preservation. The authors of Rinehart and Ippolito 2014 are less concerned with practical issues than other experts in the field and instead pinpoint the institutional, technological, and legal “threats” to the preservation of New Media Art.

Buschmann, Renate, ed. *Media Art Installations: Preservation and Presentation; Materializing the Ephemeral*. Berlin: Reimer, 2013.

Buschmann’s anthology introduces the theoretical and practical approaches to the preservation and presentation of new media installations.

Cook, Sarah, and Beryl Graham. *Rethinking Curating: Art after New Media*. Cambridge, MA: MIT, 2010.

On the basis of a discussion of the distinctive features of New Media Art, Cook and Graham discuss the possibilities of curating New Media Art in a museum context and, moreover, in ever-changing (hybrid) environments, such as festivals and on the internet.

Graham, Beryl, ed. *New Collecting: Exhibiting and Audiences after New Media Art*. London: Ashgate, 2014.

New Collecting addresses the issues of professionals who are concerned with collecting and preserving New Media Art and strives to fill the gap of practical guidebooks.

Grau, Oliver. “The Database of Virtual Art: For an Expanded Concept of Documentation.” In *ICHIM, École du Louvre, Cultural institutions and digital technology, acte publié avec le soutien de la Mission de la Recherche et de la Technologie du Ministère de la Culture et de la Communication*, 2–15. Paris, 2003.

Digital art is totally dependent upon storage media and the permanently changing operating systems that support it. This is an entirely new and challenging situation for art conservators and curators. The novel, specially developed database model and its expanded concept document in detail the rapid development of this art form and the fundamental uniqueness of contemporary digital artworks.

Grau, Oliver. “Media Art’s Challenge for Our Societies. New Structures for 21st Centuries Humanities.” In *The Challenges of*

***the Object, Proceedings of the 33rd Congress of the International Committee of the History of Art; Nürnberg, 15th–20th of July 2012.* Edited by G. Ulrich Großmann and Petra Krutisch, 990–994. Nuremberg, Germany: Verlag das Germanischen Nationalmuseums, 2012.**

Even though New Media Art is a vivid contemporary factor, it has not yet arrived in the core cultural institutions of contemporary societies. The author argues that an appropriate international structure is needed to support media art documentation, collection, preservation, and research.

Rinehart, Richard, and Jon Ippolito. *Re-Collection: Art, New Media, Social Memory*. Cambridge, MA: MIT, 2014.

This monograph contributes several prolific observations to the ongoing debate of the lack of preservation of New Media Art. Rinehart and Ippolito identify three main “strands”: technology, institutions, and law.

Serexhe, Bernhard, ed. *Preservation of Digital Art: Theory and Practice: The Project Digital Art Conservation*. Vienna: AMBRA Verlag, 2013.

Emerging from a three-year project, this anthology offers a collection of texts concerning ethics and philosophical implications of conservation, as well as practical approaches to preservation on the basis of various case studies.

Online Archives and Platforms

Even though New Media Art has contributed substantially to contemporary art, it still lacks a stable and continuous representation in cultural institutions. Worldwide initiatives, such as the Media Art History Declaration (the so-called Liverpool Declaration), aim to reinforce the research, archiving, and restoration of New Media Art and raise awareness of the fact that, because of the progress in technology, much of New Media Art can no longer be displayed. The actors in New Media Art, namely, its scholars, artists, and engineers, started to debate and exchange information via electronic and digital media at an early stage. Mailing lists were—and still are—a common tool of communication. At the end of the 1990s, the first online databases came into being and still are essential resources for acquiring information about New Media Art. The pioneering, university-based ADA: Archive of Digital Art is a comprehensive database that comprises a selection of artists and scholars in the field of science, art, and technology. Rhizome is a non-academia-based New York-based initiative concentrating on digital art. Even though the funding of some online projects was discontinued, their websites are nonetheless helpful (even though partly outdated), such as the Daniel Langlois Foundation and Media Art Net/Medien Kunst Netz. Monoskop offers a well-edited overview of media art, ranging from the classical avant-garde to contemporary practices in New Media Art.

ADA: Archive of Digital Art.

Introduced as the Database of Virtual Art in the late 1990s, the Archive of Digital Art offers a rich documentation of the main proponents of digital art. Hundreds of artists and scholars, who have a minimum of five exhibitions or publications, are qualified members of the collective scholarly research platform. Archive under active development.

Compart.

Compart is an active online database that focuses on the early history of digital art and computer art.

Langlois Foundation.

This nonactive database concentrates on the interrelation of art, science, and technology.

Media Art History Declaration.

An international initiative by hundreds of leading scholars and museum directors to draw attention on the need for an international and sustainable research infrastructure.

Media Art Net/Medien Kunst Netz.

Along with a publication of the same name (Frieling and Daniels 2004, cited under General Overviews), this outdated online archive offers various texts that are (conveniently) cross-referenced. Development ended in 2007.

Monoskop.

Monoskop consists of a wiki page that offers information about the intersection of art and media.

Rhizome.

Rhizome is a New York-based non-academia-based online archive dedicated to digital art.

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